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Class: 3E1

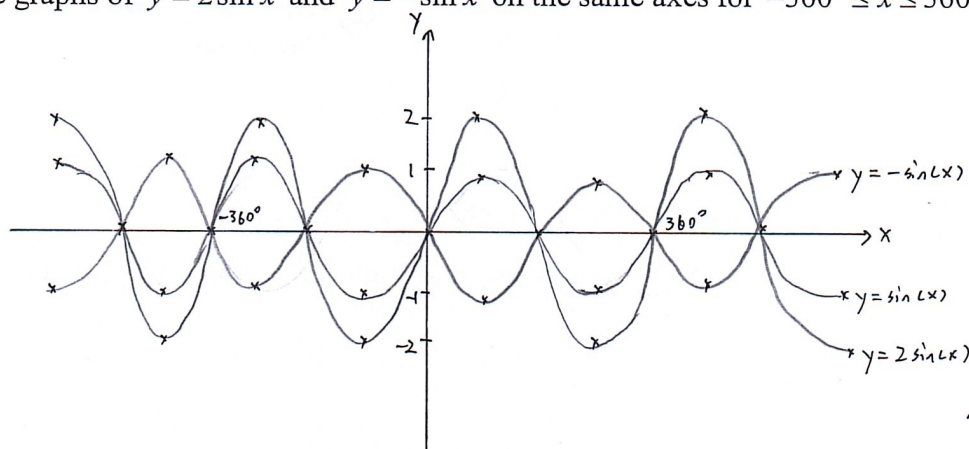
Date: 17th Sep

MA304.5.3 – Transformation of Trigonometric Graphs

At the end of this unit, you should be able to

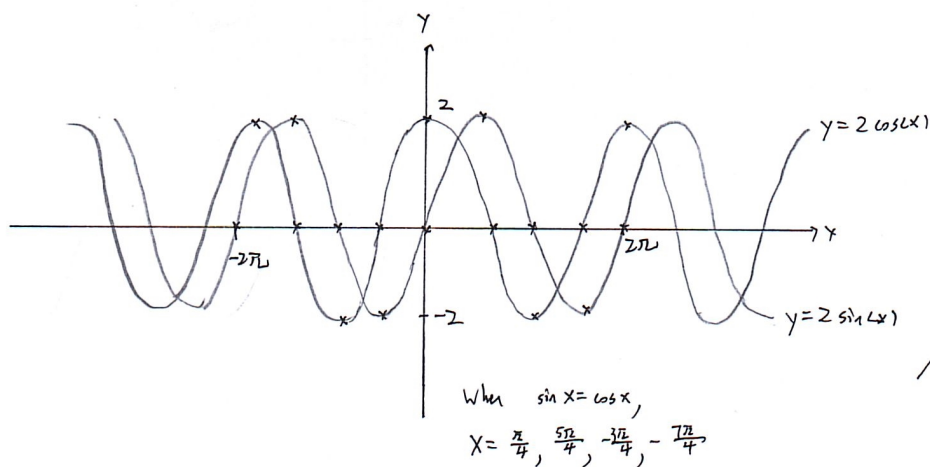
- sketch simple transformations of trigonometric graphs

E1. Sketch the graphs of $y = 2 \sin x$ and $y = -\sin x$ on the same axes for $-360^\circ \leq x \leq 360^\circ$.

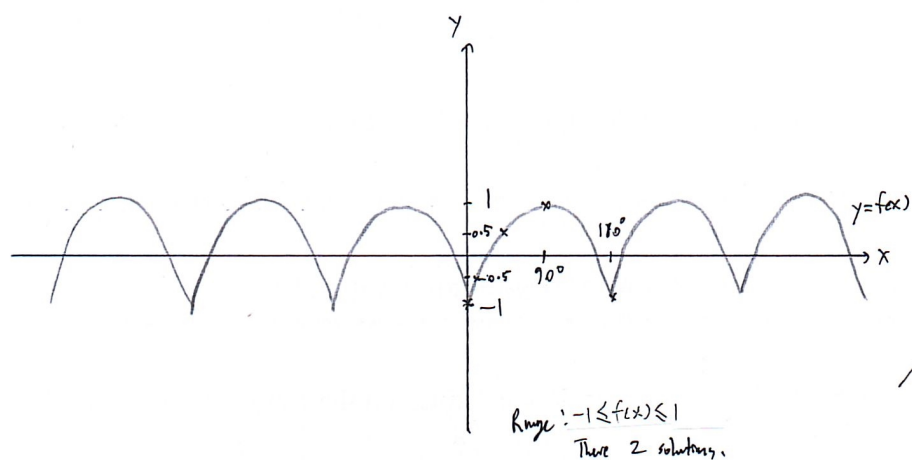


P1. Sketch the graphs of $y = 2 \sin x$ and $y = 2 \cos x$ on the same axes for $-2\pi \leq x \leq 2\pi$.

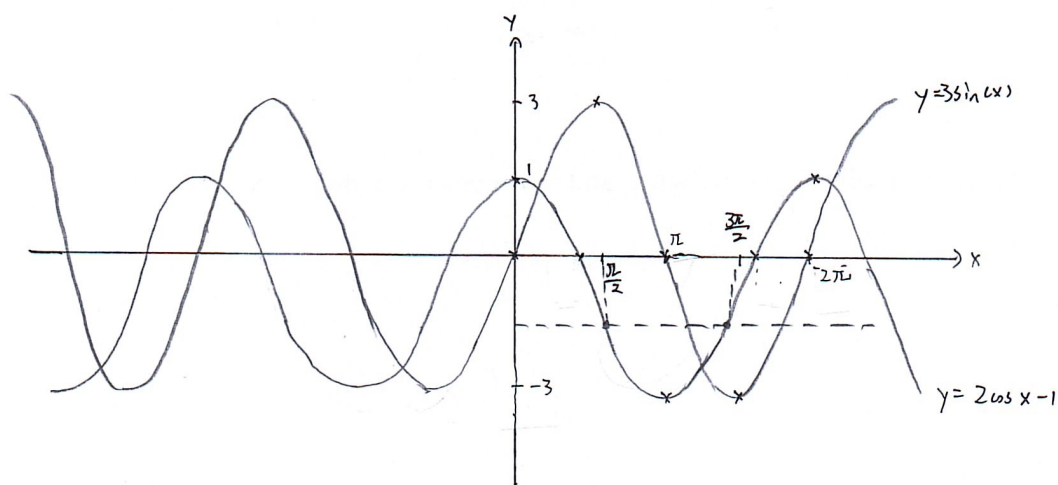
Hence determine the values of x where $\sin x = \cos x$.



E2. Sketch the function $f: x \rightarrow 2|\sin x| - 1$ for $0^\circ \leq x \leq 180^\circ$. State the range of f . Hence, using the graph, determine how many solutions there are to the equation $|\sin x| = 0.5$.



P2. On the same diagram, sketch the graphs of $y = 3 \sin x$ and $y = 2 \cos x - 1$ for the interval $0 \leq x \leq 2\pi$. State the number of solutions, in this interval, of the equation $3 \sin x + 1 = 2 \cos x$.



There 2 solutions.

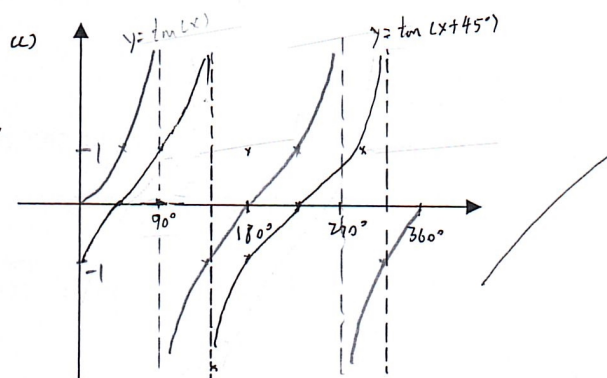
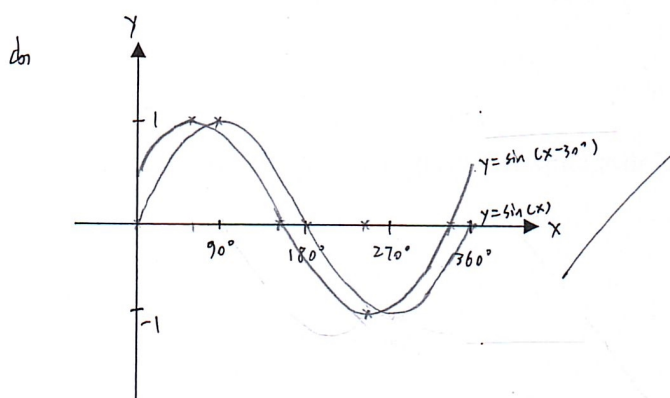
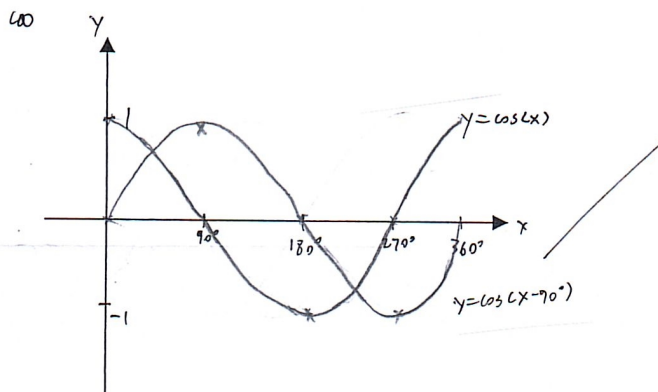
Transformation of trigonometric graphs

E3. For each of the following pairs of graphs, sketch on the same axes for $0^\circ < x < 360^\circ$:

(a) $y = \cos x$ and $y = \cos(x - 90^\circ)$

(b) $y = \sin x$ and $y = \sin(x - 30^\circ)$

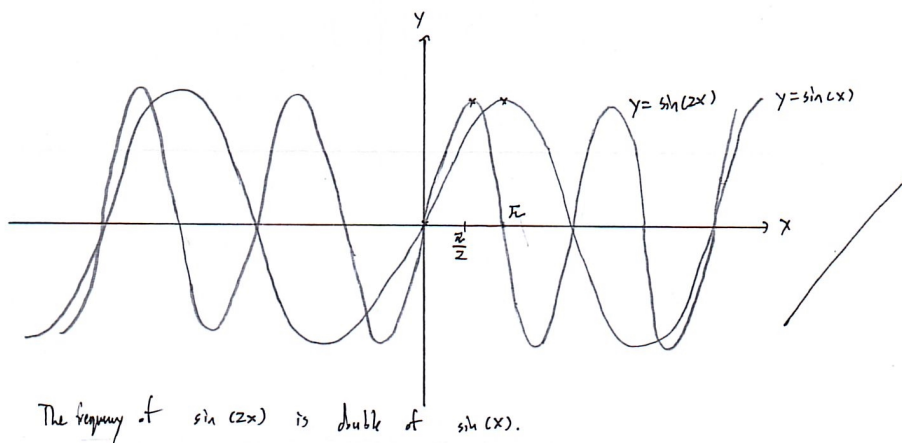
(c) $y = \tan x$ and $y = \tan(x + 45^\circ)$



Describe the type of transformation that has taken place.

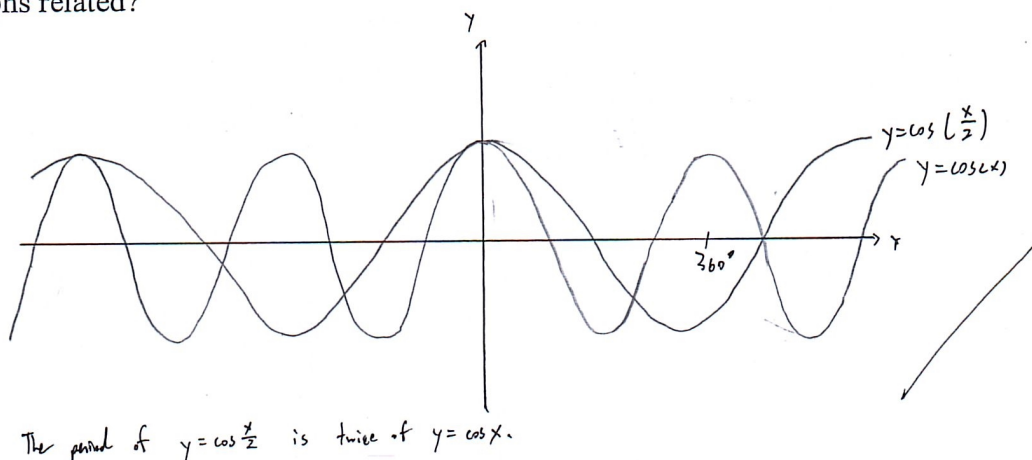
The graph is translated by the number of degrees.

E4. Sketch the graphs of $y = \sin x$ and $y = \sin 2x$ for $0 < x < \pi$. How are the periods of the two graphs related?



The frequency of $\sin(2x)$ is double of $\sin(x)$.

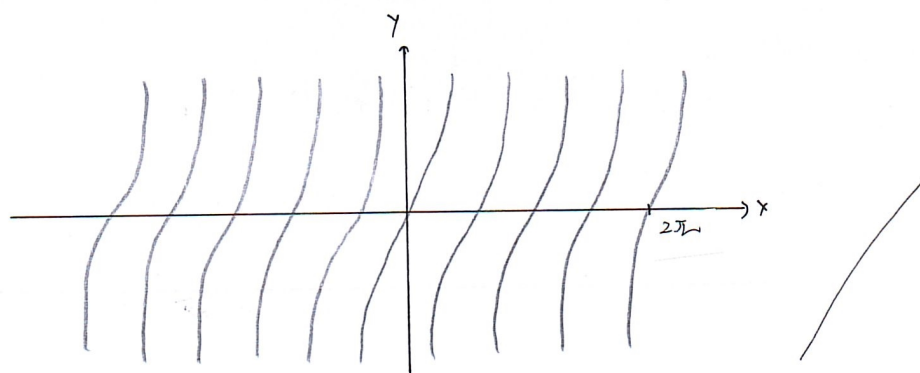
P3. Sketch the graphs of $y = \cos x$ and $y = \cos \frac{x}{2}$ for $0^\circ < x < 360^\circ$. How are the periods of the two graphs related?



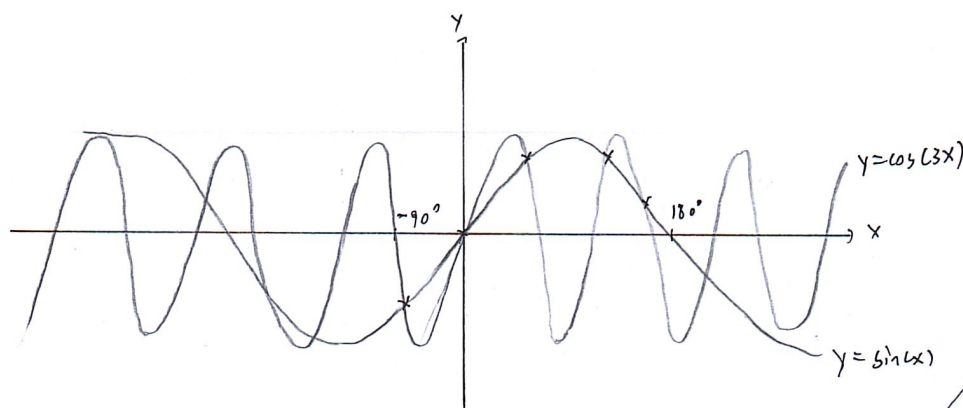
P4. Can you make a guess about the relationship between the periods of $y = \tan x$ and $y = \tan bx$ where b is a positive integer?

$$\text{Period of } y = \tan bx = \frac{180^\circ}{b}$$

P5. Draw $y = \tan 2x$ for $0 \leq x \leq 2\pi$.



P6. Using the aid of graphs, determine the number of solutions of the equation $\cos 3x = \sin x$ in the interval $-90^\circ \leq x \leq 180^\circ$.

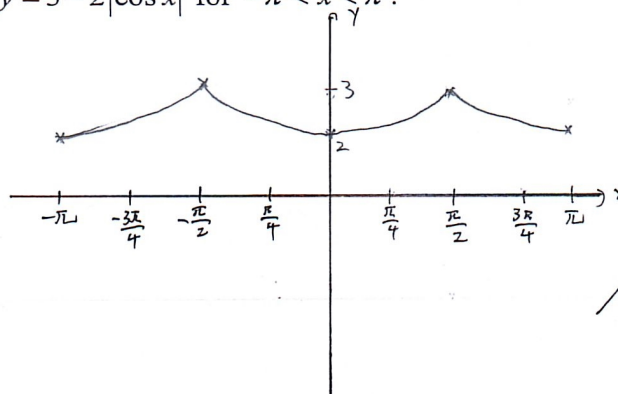


There are 5 solutions.

The above can be summarised through a table.

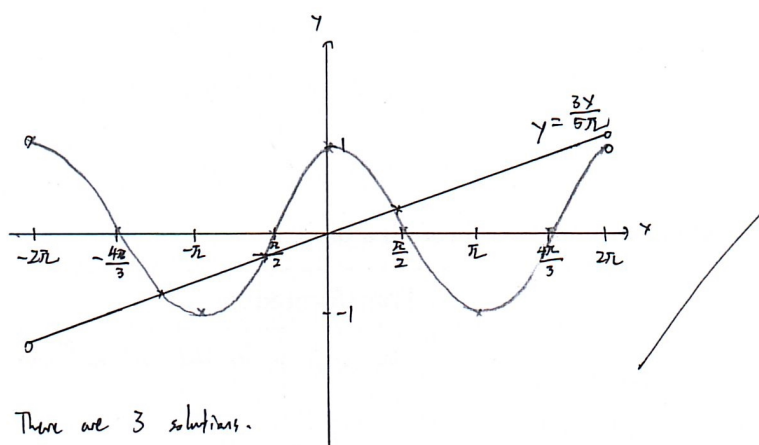
Function	Transformation
$y = \sin(x - k)$ where $k > 0^\circ$ $y = \cos(x - k)$ where $k > 0^\circ$ $y = \tan(x - k)$ where $k > 0^\circ$	The graph is translated in the ^{positive} x-axis by k° .
$y = \sin(x + k)$ where $k > 0^\circ$ $y = \cos(x + k)$ where $k > 0^\circ$ $y = \tan(x + k)$ where $k > 0^\circ$	The graph is translated in the negative x-axis by k° .
$y = \sin(bx)$ where $0 < b < 1$ $y = \cos(bx)$ where $0 < b < 1$ $y = \tan(bx)$ where $0 < b < 1$	The graph is stretched parallel to x-axis by a scale factor of $\frac{1}{b}$.
$y = \sin(bx)$ where $b > 1$ $y = \cos(bx)$ where $b > 1$ $y = \tan(bx)$ where $b > 1$	The graph is compressed parallel to x-axis by a scale factor of $\frac{1}{b}$.

P7. Sketch the graph of $y = 3 - 2|\cos x|$ for $-\pi < x < \pi$.

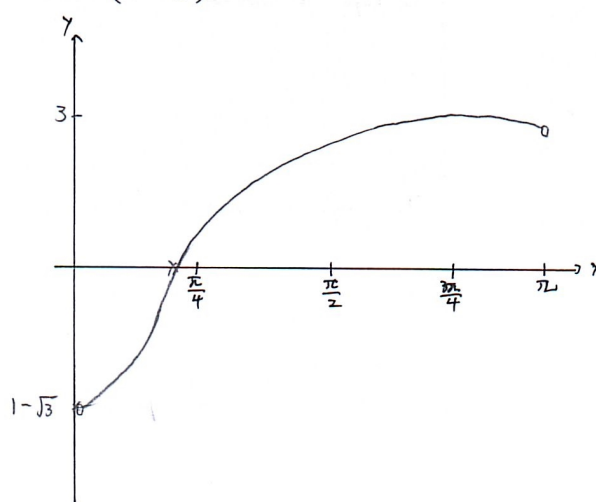


P8. Using the aid of graphs, determine the number of solutions of x between -2π and 2π

such that $\cos x = \frac{3x}{5\pi}$.



P9. Sketch the graph of $y = 2\sin\left(x - \frac{\pi}{3}\right) + 1$ for $0 < x < \pi$ and state the range of y .



Range of y : $1 - \sqrt{3} < y < 3$